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NEW TAXA OF BRACHYURAN CRABS FROM DEEP WATER OFF WESTERN PERU
AND COSTA RICA

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ABSTRACT: Five new species and one new genus of brachyuran crabs obtained by E. M. del Solar and E. Fernandez-B. are described and illustrated. Of these, *Homolodromia robertsi*, *Acanthocarpus delsolari*, *Pilumnus fernandezi*, and *Trizocarcinus peruvianus* are most closely related to western Atlantic deep-water species, whereas, *Delsolaria enriquei*, a new genus and species, is a west American endemic. The family Homolodromiidae and the genera *Homolodromia* and *Acanthocarpus* are reported for the first time from the eastern Pacific. It is postulated that the analogous pairs of deep-water Amphi-american species have been separated since free communication existed at or near the depths at which they presently occur. The Bolivar Trench which extends across northern South America is suggested as the probable Miocene or earlier connection.

Through the efforts of Enrique M. del Solar-C., technical adviser to IMARPE (Instituto del Mar del Perú), carcinological collections from a hitherto untapped source have lately found their way into museums in the United States and western Europe, among them the Allan Hancock Foundation (AHF), Los Angeles, the U.S. National Museum of Natural History (USNM), Washington, and the Royal Netherlands Museum (RNM), Leiden. These come from deep waters off Perú, and are the by-product of a search for edible shrimp and other fisheries products conducted by the research vessels "Wiracochoa," "Challua japic," and "SNP-1" under the direction of del Solar. Independent probing of deep waters off western Costa Rica by Hno. Eduardo Fernandez-B., Colegio de La Salle, San José, has similarly enriched the collections of the U.S. National Museum.

Not only have a number of the brachyuran species proven to be new to science, but represented among them are genera and families not previously known to inhabit the eastern Pacific. Four of the new species described herein have already been mentioned in Peruvian journals (del Solar, Blancas, and Mayta, 1970; del Solar, 1972) with identifications to genus only, and three have been illustrated (Chirichigno, 1970), but without specific names. Since the genera under which

they were first reported may differ from the ones used here, and since the published illustrations are sometimes insufficient for species identification, citations to the above are given for clarification only, and are not intended to establish priority for the species in question, which dates solely from this publication. This paper is Allan Hancock Foundation Contribution No. 343.

SYSTEMATIC ACCOUNT

Family HOMOLODROMIIDAE

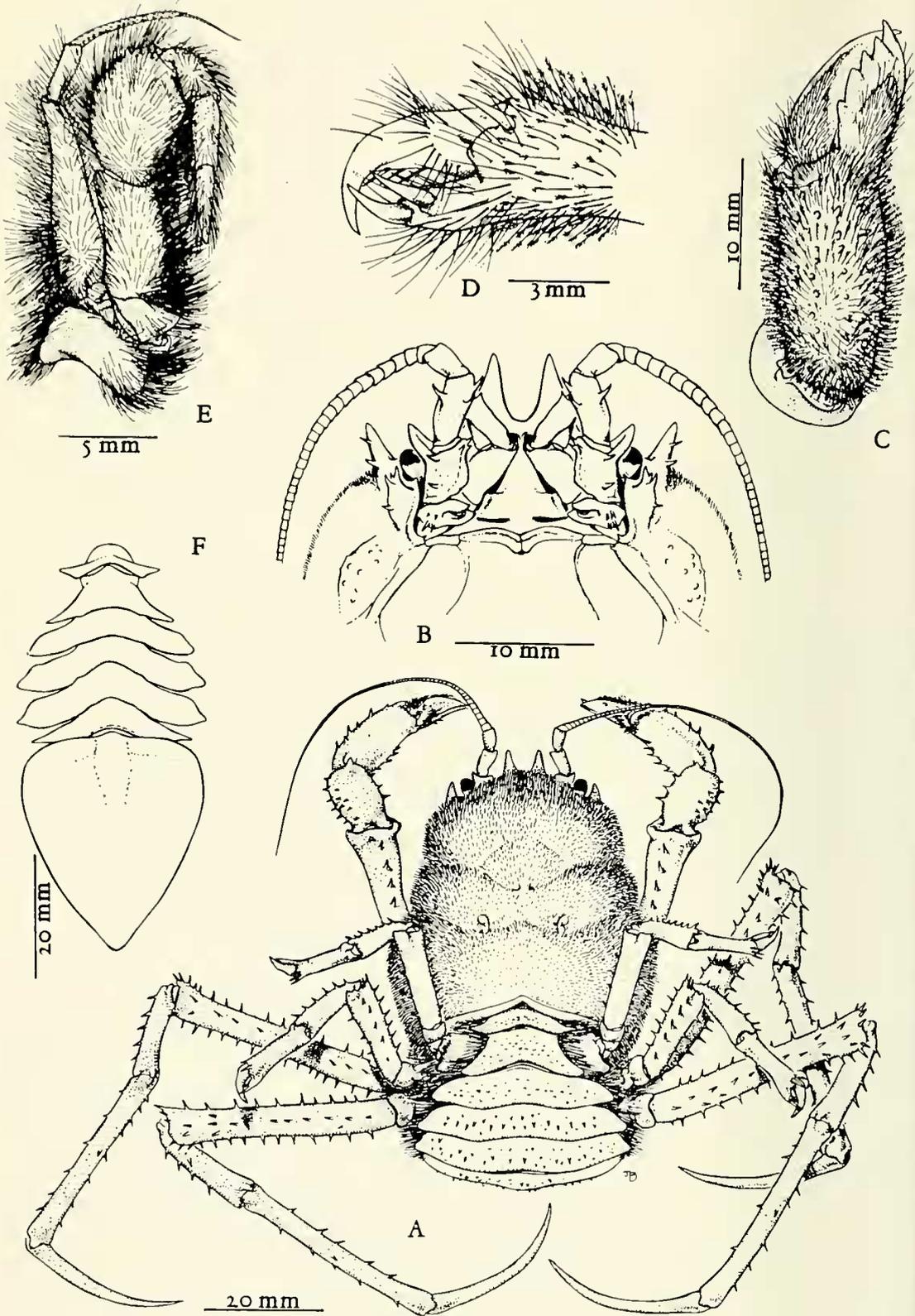
Homolodromia robertsi, new species

Figure 1. A-F

Type: Female, holotype, AHF No. 719, from off Perú, lat. 03°48.5' S, long. 81°18.4' W, 800 m, 11 January 1971, mud bottom, E. M. del Solar, collector (Orig. No. B-260). Ovigerous female, paratype, USNM No. 141570, from off Perú, lat. 07°59' S, long. 80°22' W, 800 m, 26 November 1971, hard bottom, Trawler "Challua japic," E. M. del Solar, collector (Orig. No. B-376).

Measurements (all in millimeters): Female holotype: length, including rostrum, 42.5, width, 38.0, length of rostrum, 4.0, width of rostrum, 7.5, cheliped

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(coxa-ischium-merus, 35.4, carpus-propodus, 37.8), 73.2, chela, 28.0, dactyl, 13.5, height of palm, 7.2, walking legs, from first to last, 98, 90, 36, and 39.

Diagnosis: Rostral and exorbital spines short and subequal, the latter more forwardly than outwardly directed. Median and lateral portions of cervical suture continuous. Carapace, chelipeds, and walking legs spinulose.

Description: Carapace thick, swollen, pilose, surface spinulose, punctate, divided by cervical and branchial sutures into unequal thirds. Posterior branchial regions dilated, limited anteriorly by branchial furrow; anterior branchial regions similarly delimited from gastric and hepatic regions by cervical furrow. Front with two stout, triangular horns reaching extremity of third article of antenna, outer margins sloping toward a similar and forward-directed exorbital spine. Rostral horns and outer orbital spines straight, tubular, the former flattened beneath, the latter spinulose externally. Eyestalks thick, short, cylindrical, two spinules at base; cornea terminal, of diameter equal to eyestalk, color yellowish brown. Supraorbital margin smooth, with a narrow raised border bearing one or two spinules. Lateral margins spinulose, constricted by the aforementioned grooves. Basal antennal article with concealed green-gland opening internally, three or four spinules externally, the outer two in line; second article with two spinules in line externally, a cluster of spinules anterointernally, and a large spine anteroexternally; third (first flagellar) article with a subdistal spinule externally and two spinules in line internally.

Outer maxilliped densely haired, especially along internal margin, merus broader than ischium, arcuate outer margin spinulose; palp coarse, cylindrical.

Chelipeds of female equal, pilose, margins of merus, carpus, and manus spinulose, prehensile margins of fingers dentate, dactylus fitting into a fork-tipped propodus. First two pairs of ambulatory legs long, slender, cylindrical, pilose, spinulose, dactyli long and strongly curved. Last two pairs of legs short, elevated, chelate, chela of third leg directed backward, that of the fourth leg directed forward, dactyl fitting a fork formed by two or more propodal spines.

Female abdomen with seven free segments, seventh segment cordiform, longer than preceding six. The male of the species is unknown.

Remarks: *Homolodromia robertsi* differs from the western Atlantic *Homolodromia paradoxa* A. Milne-Edwards, 1880, as follows: shorter rostral and exorbital spines, the latter more forwardly than outwardly directed; the median portion of

the cervical suture continuous with the lateral portions; the carapace and the walking legs spinulose; and in having the legs of the last two pairs shorter, although this may be a character associated with the female sex. The new species differs from the East African *Homolodromia bouvieri* Doflein, 1904, in having the carapace broader posteriorly, the furrows more clearly discernible, giving it a tightly laced appearance, the rostral and exorbital spines are straight instead of incurving (cf. Doflein, 1904, text-fig. 1), the eyestalks short and thick, the cornea pigmented, the outer maxilliped thicker, the antennal peduncle and walking legs more spinulose, including the meri and propodi, which in *H. bouvieri* are without spinules.

I take pleasure in naming this new species for Henry B. Roberts, Senior Museum Specialist, U.S. National Museum of Natural History, Washington, D.C., whose assistance in preparing its description is gratefully acknowledged.

Family CALAPPIDAE

Acanthocarpus delsolari, new species

Figure 2, A-F

Mursia sp. Chirichigno, 1970, p. 41, text-fig. 85.

Type: Holotype, female, AHF No. 703, from near Banco de Mánora, off Perú, lat. 03°43' S. long. 81°03' W, 250 m, mud bottom, 30 August 1970, E. M. del Solar, collector (Orig. No. B-204).

Measurements (in millimeters): Female holotype: length, 25.3, breadth, 27.6, frontal width, 3.4, fronto-orbital width, 10.8, length of meral spine, 11.0, length of chela, 17.9, dactyl, 7.8, height of palm, 12.1. Overall width, including meral spines, 60.5.

Diagnosis: Carapace ovate, posterolateral spine of moderate length. Two meral spines, the inferior much the longer. Posterolateral margin non-tuberculate. A tooth on posterior margin and a conical tubercle on either side of sternal plastron. Tubercles of carapace arranged in longitudinal rows, most prominent posteriorly and laterally.

Description: Carapace regularly convex, widest opposite middle, surface uneven, protuberances arranged in five longitudinal rows of which one is median, tubercles of lateral ridges increasingly prominent posteriorly, tending to coalesce, the outermost protruding beyond posterolateral margin, which

Figure 1. *Homolodromia robertsi*, new species, female holotype: A, dorsal view; B, ventral view of frontal region; C, outer view of right chela; D, tip of left third walking leg; E, right outer maxilliped; F, abdomen.

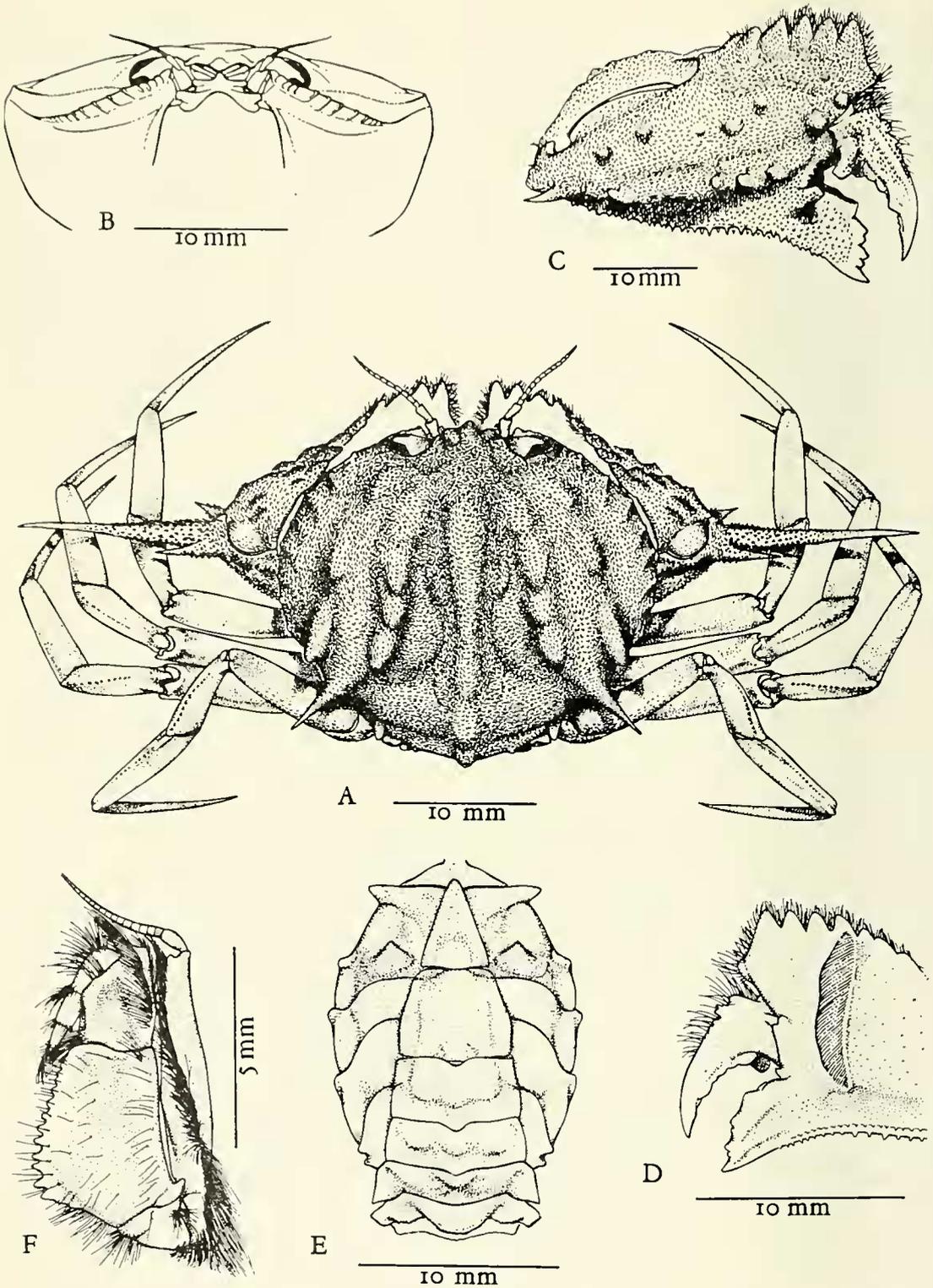


Figure 2. *Acanthocarpus delsolari*, new species, female holotype: A, dorsal view; B, frontal view, showing suborbital tubercles; C, outer view of right cheliped; D, inner view of same, showing stridulating ridge; E, abdomen and sternal plastron; F, left outer maxilliped.

bears a moderately long, conical, more laterally than posteriorly directed spine. Surface covered with minute granules and punctae. Front moderately wide, trilobate, separated from orbit by a shallow notch. Orbits large, margins hairy, superior fissure obsolescent. Anterolateral margin with four obscure tuberculiform teeth, followed by three smaller tubercles at widest part of carapace. Posterior margin arcuate, bearing a large tooth at middle and a smaller tooth on either side.

Spine at outer angle of merus of cheliped approximately two-fifths width of carapace; superior spine approximately one-fifth length of inferior. Hand with a seven-toothed crest above and an oblique, five-toothed crest on outer surface extending from base of dactylus to posteroinferior angle; posterior tooth largest, conical, separated from other teeth by a considerable interval. Six or seven scattered tubercles forming an irregular line between upper and lower crests. Stridulating ridge on inner surface of manus composed of about 47 closely placed, oblique striae, which engage a series of coarser oblique tubercles on the suborbital margin to produce the vibratory grating described for *Acanthocarpus bispinosus* by Rathbun (1937:224).

Outer maxilliped truncate-triangular, inner margin of ischium denticulate, a diagonal row of setae crossing exognath and merus of endognath.

Ambulatory legs naked, unarmed, surface smooth and polished, carpi ridged, propodi laterally compressed, dactyli long, vertically compressed, incurving. A conical tubercle on either side of first sternite.

The male of the species is unknown.

Color in alcohol: Carapace reddish orange, deepest on anterior portion. A spot of orange surrounding each stridulating ridge.

Remarks: The proposed new species appears to be more closely related to *Acanthocarpus alexandri* Stimpson, 1871 (Massachusetts to Windward Islands), type species of the genus, than to *A. bispinosus* A. Milne-Edwards, 1880 (Florida Straits to Windward Islands). *Acanthocarpus delsolari* resembles the former in having the carapace narrowing posteriorly; two meral spines, the inferior the larger; a tooth on the posterior margin; and a pair of tubercles on the sternal plastron. Furthermore, while the postlateral spine is longer than in *alexandri*, it is not as long as in *bispinosus*, nor as laterally directed. *Acanthocarpus delsolari* differs from both in having prominent branchial tuberculate ridges, the outermost actually overhanging the posterolateral margin.

I take pleasure in naming this species for E. M. del Solar, of Lima, Perú, who recognized it as belonging to a genus hitherto unreported from the American west coast.

Family MAJIDAE

Delsolaria, new genus

Type species: *Delsolaria enriquei*, new species

Description: Carapace ovate-triangular, regions elevated and tuberculated, posterior margin lamellate. Rostrum consisting of two flattened horns. Orbits small, a fissure above and below, the lower one open. Preorbital spine and postorbital cup closely approximated, intercalary spine absent. Basal antennal article broadened basally, forming floor of orbit, a stout spine at anteroexternal angle. Maxilliped with exognath as wide as endognath proximally, ischium widening distally, merus truncate distally, expanded anteroexternally, notched at anterointernal angle. Chelipeds of female slightly more robust than walking legs, manus compressed and carinated, fingers pointed. Walking legs short and stout, carpi tuberculated.

Abdomen of female seven-segmented; male sex unknown.

Relationship: The new genus appears to belong among those genera of the subfamily Pisinae in which the supraocular cave is in close contact with the postocular cup. However, the remarkable broadening of the basal antennal article suggests affinities with certain genera of the subfamily Majinae as well. Final placement and inclusion in a key must await the discovery of a male specimen.

Delsolaria enriquei, new species

Figure 3, A-F

Type: Female, holotype. AHF No. 704, from north side of Banco de Máncora, Perú, 35 m. gravel. 9 December 1970. E. M. del Solar, collector (Orig. No. B-256).

Measurements (in millimeters): Female holotype: length, including rostrum, 37.7, rostrum, 6.2, width at level of branchial spines, 29.6, at level of posterolateral margin, 26.4, cheliped (ischium-merus 12.7, carpus-propodus 17.0), 27.7, chela, 13.8, dactyl, 6.6, height of palm, 4.7.

Diagnosis: Gastric, cardiac, and branchial regions swollen and tuberculate. Lateral branchial tubercle prominent. Rostral, preorbital, and antennal spines of like size and sharpness. Maxilliped distally fringed with clavate setae.

Description: Carapace ovate-triangular, one and one-quarter times longer than wide, highly convex medianly and laterally, elevations studded with rounded tubercles, depressions smooth but microscopically punctate, sides declivitous, posterior margin lamellate. Front bifid, horns sharp, cleft shallow, U-shaped, sides parallel or slightly concave, a double row of curled setae on each; frontal, antennal, and preorbital spines of comparable size and sharpness.

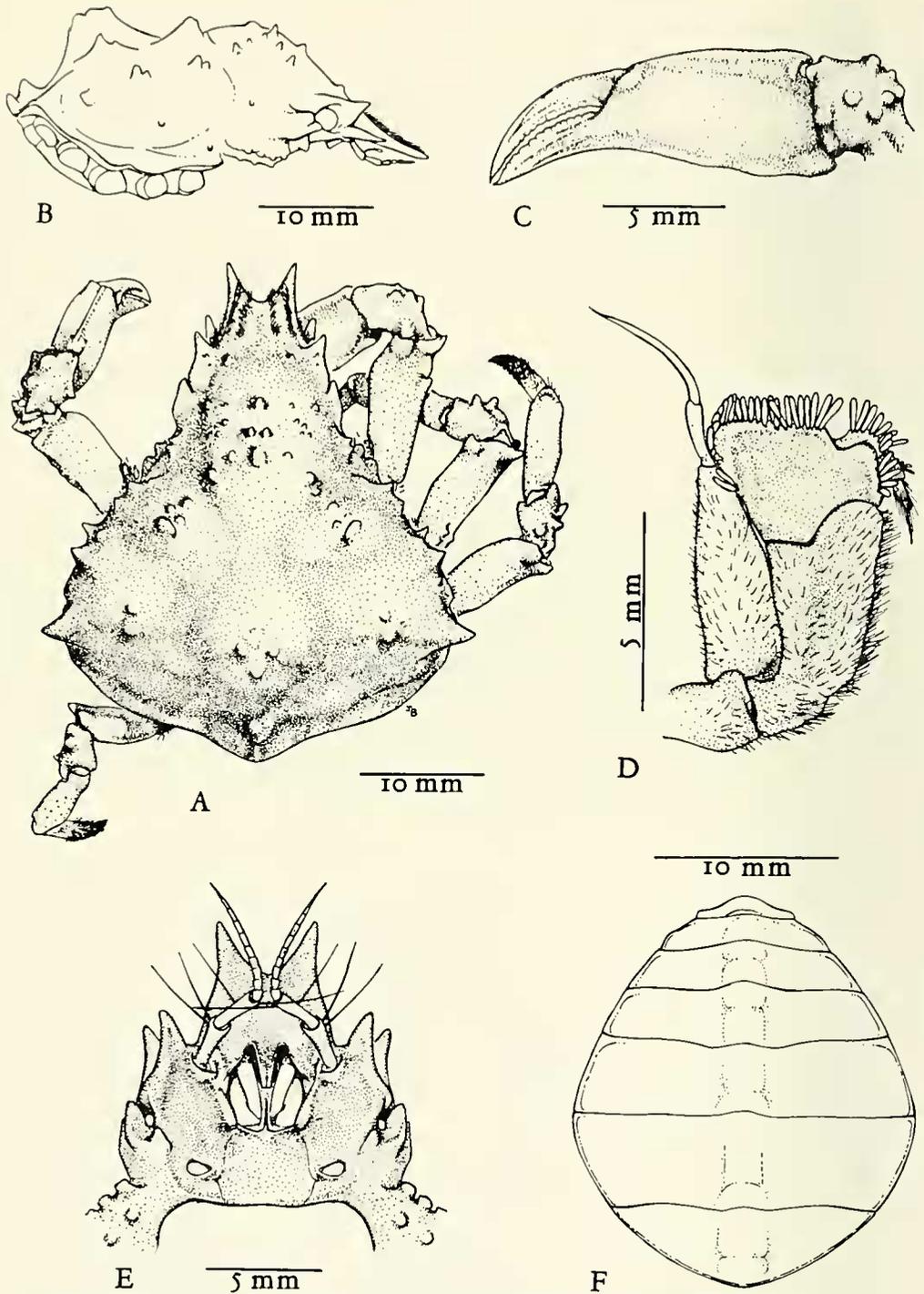


Figure 3. *Delsolaria enriquei*, new species, female holotype: A, dorsal view; B, right lateral view; C, left chela, outer view; D, right outer maxilliped; E, ventral view of frontal region; F, abdomen.

Preorbital spine with outer margin concave, separated by a narrow slit from postorbital cup into which eye retracts, leaving but a fraction of the cornea visible from above, a slight constriction behind postorbital cup. Gastric region broad, swollen, surmounted by a dozen or more small tubercles of which two are median, the others paired; epibranchial regions surmounted by a single large tubercle, with lesser tubercles in advance and on outer slope; mesobranchial regions with three large tubercles forming a triangle, the anterior in line with the lateral and outer epibranchial, the interior in a line with the lateral and anterior cardiac tubercle; cardiac region most elevated, with four tubercles in a diamond with two in line, sides sloping from summit in all directions; sides of hepatic and branchial regions each with one or two small tubercles; intestinal region low, pinched, marked by a single median spine; posterior margin thin, broadly rounded, slightly sinuous, a notch marking off a small lobe at base of second walking leg.

Basal antennal article broad, spine at anteroexternal angle visible from above. Pterygostomial region with a double row of four rounded tubercles.

Exognath of outer maxilliped as broad basally as endognath; ischium of endognath widening distally, invading merus internally, merus broadening anteriorly, expanded externally, and notched internally to receive palpus; distal margins of merus and palpus fringed with clavate setae.

Chelipeds of female slightly more robust than walking legs, merus with anterior and external margins cristate, outer crest with a subterminal spine; carpus tuberculate; manus narrowing distally, crested above and below, fingers long, slender, pointed, downcurving, incurving, ribbed, and multidenticulate.

Walking legs, of which most are missing from the type specimen, short, cylindrical, diminishing in length from first to last, carpi tuberculated, dactyli robust, setose, those of the last pair nearly as long as their propodi, tips incurving.

Female abdomen with seven free segments, each with a low median tubercle.

The male of the species is unknown.

Family XANTHIDAE

Pilumnus fernandezi, new species

Figure 4, A-F

Pilumnus sp. Chirichigno, 1970, p. 55, text-figs. 128, 129.

Type: Male, holotype, USNM No. 141571, Pacific side of Costa Rica, 80 m, E. Fernandez-B., collector (Orig. No. 13). Male, paratype, AHF No. 698, from off Punta Sal, Perú (lat. 03°59' S), 180 m, on continental shelf, 9 May 1969, E. M. del Solar, collector (Orig. No. B-20).

Measurements (in millimeters): Holotype male:

length of carapace, 35.5, width of carapace, including spines, 47.8, length of cheliped (coxa-ischium minus 29.0, carpus-propodus 38.3), 67.3, length of chela, 37.0, of dactyl, 21.0, height of palm, 18.7 Paratype male: length, 29.2, width, including spines, 37.9

Diagnosis: Carapace convex, four anterolateral spines, a subhepatic spine. Three spinules in line inside anterolateral spines. Chelipeds and walking legs spinulous, color of fingers terminating short of palm. Merus of outer maxilliped pentagonal. Tip of first male pleopod doubly recurved.

Description: Carapace one and one-third times broader than long, strongly convex anteroposteriorly, slightly convex from side to side; regions indicated only by a groove outlining the anterior mesogastric, an obtusely angular groove defining the hepatic region, and an H-shaped depression separating the urogastric from the cardiac region; sparsely hairy, with a row of three spinulous granules paralleling the anterolateral margins, and numerous lesser spinules. Front advanced, consisting of two slightly oblique lobes separated by a wide and deep U-shaped sinus, each lobe bearing three spinules; an antennal spinule standing between front and orbit. Orbits broad, spinulous margined, of the spines on upper margin, one next antennal spine and one at about middle, two closed fissures above, three outer lower marginal spines and two inner, the latter on an advanced process bearing two spinules in a longitudinal line on basal portion. Anterolateral spines four, including exorbital spine, each with a conical base and slender tip, inclining successively more outward and upward. Carapace widest opposite fourth spine. Pterygostomial region granulate; a subhepatic spine with a second spinule beneath it. Sternum densely granulate.

Merus of external maxilliped, owing to an inner projection, pentagonal, outer angle rounded, not produced, surface with two shallow depressions, granulate, and hairy.

Chelipeds unequal, the right larger than the left, spinulous, and hairy. Merus with five or six spines along superior margin, the two distalmost largest, curved, and separated by a U-shaped sulcus. Carpus with a prominent inner spine and outer groove as well as spines on upper and outer surface. Manus with two rows of three or four spines above, with lesser spines arranged in rows on outer surface giving way to irregularly arranged spinate tubercles on lower portion. Fingers elongate, meeting with a slight gape, tips crossing; dactyl grooved above, spinulous at base, and with a low bicuspid tooth; pollex deflexed, swollen at base, with a tricuspid tooth followed by a large and a small tooth. Color of fingers terminating in an irregular line considerably short of palm. Minor manus less robust than major, palm completely spinulous, fingers longer and slenderer, teeth thin and triangular, pollex grooved to tip.

Walking legs slender, hairy, longest almost twice the length of carapace, and spinate on anterior mar-

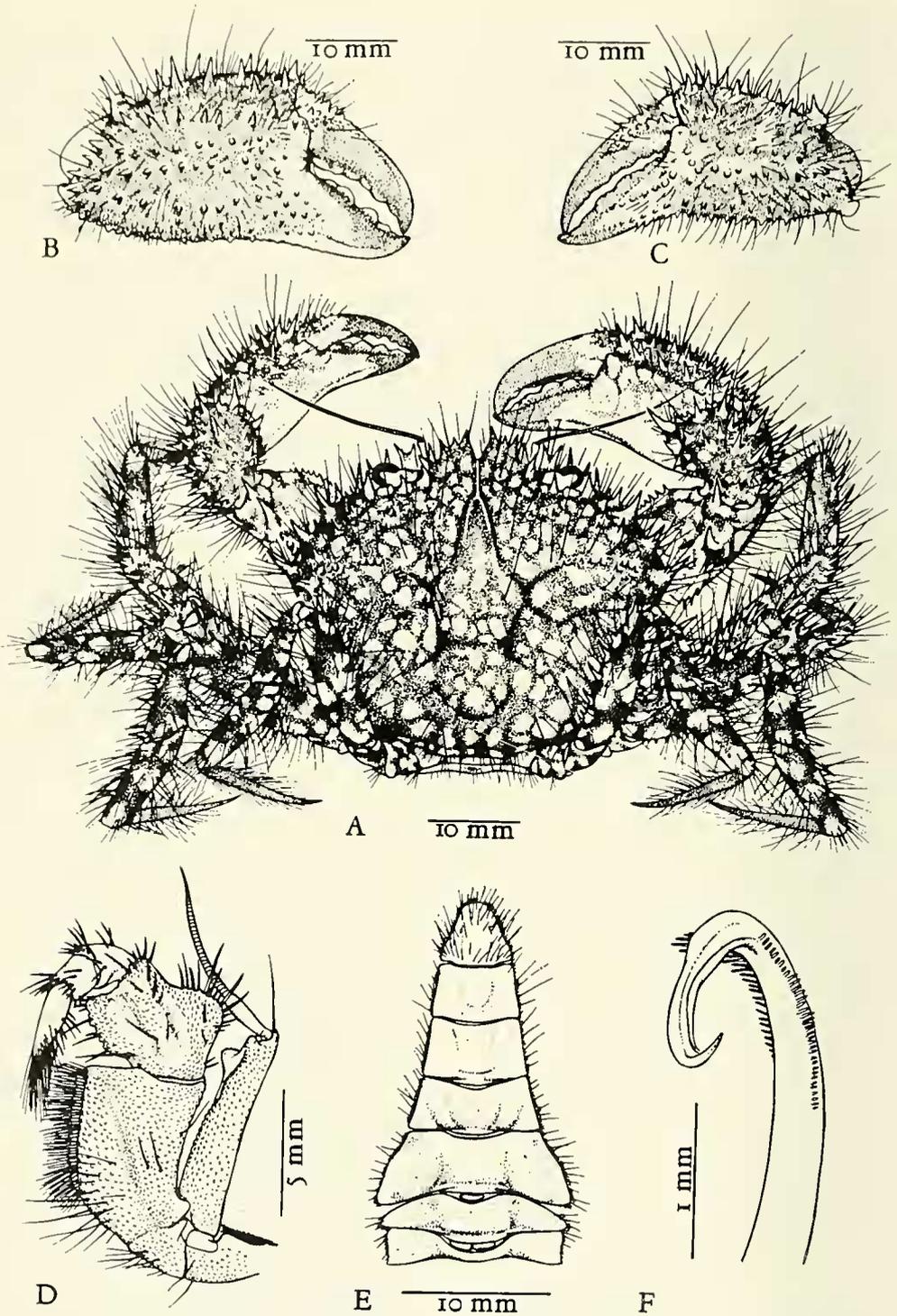


Figure 4. *Pilumnus fernandesi*, new species, male holotype: A, dorsal view; B, right chela, outer view; C, left chela, outer view; D, left third maxilliped; E, abdomen; F, tip of first pleopod.

gins of meri, carpi, and propodi; dactyli long, straight, slightly curved toward tips, nails amber.

Male abdomen smooth-textured with seven segments. The segments beyond third decreasing regularly in width, seventh segment narrowly triangular. Male first pleopod with two rows of marginal setae, tip pointed, sharply recurved.

Color in alcohol: Bright orange-red fading to salmon pink in a network leaving many whitish or cream-colored spots on carapace, chelipeds, and legs; color beneath extending from pterygostomian region onto maxillipeds and sternum. Fingers brown. Hairs golden.

Variation: The paratype from Perú differs from the holotype from Costa Rica in lacking the superior spines on the orbits; these, however, appear to have been broken off on the specimen, which is rigid due to formalin preservation. No trace can be found of the three spinules that parallel the anterolateral margin on the right sides; on the left side the anterior two of these are present but reduced in size. The tips of the fingers of the major chela are worn in the paratype and do not cross as in the holotype specimen. Otherwise, the two compare favorably.

Remarks: I take pleasure in naming this new species for Hno. Eduardo Fernandez-B., Colegio de La Salle, San José, Costa Rica.

Family GONEPLACIDAE

Trizocarcinus peruvianus, new species

Figure 5, A-G

Goneplax sp. Chirichigno, 1970, p. 61, text-fig. 150.

Type: Female, holotype, AHF No. 699, off Paíta, Perú, 80 fathoms (144 m), 10 May 1969, epibenthonic net, E. M. del Solar, collector (Orig. No. B-106). Male, paratype, AHF No. 705, off Perú, depth not stated, 25 February 1970, E. M. del Solar, collector (Orig. No. B-106).

Measurements (in millimeters): Female, holotype: length, 13.1, width, including spines, 19.1, frontal width, 5.5, fronto-orbital width, 16.0, length of right chela, 16.3, of dactyl, 8.7, height of palm, 5.1. Male, paratype: length, 19.9, width, including spines, 28.9, frontal width, 8.2, fronto-orbital width, 22.6, length of right chela, 25.9, of dactyl, 13.5, height of palm, 8.4.

Diagnosis: Only two anterolateral teeth, including exorbital tooth. A sharp transverse ridge opposite lateral tooth. Chelae covered with matted hairs. An infraorbital tooth. No pterygostomian stridulating ridge. Male first pleopod long, straight, attenuated.

Description: Carapace about two-thirds as long as broad, cardiac and posterior branchial regions crossed by a blunt transverse ridge, gastric and anterior branchial regions crossed by a sharper transverse ridge; these ridges dividing carapace into thirds, each inclined at a different plane. Carapace uneven, espe-

cially posterior two-thirds; mesogastric and cardiac regions clearly delimited. Posterior branchial regions swollen, each with a blunt ridge parallel to the converging posterolateral borders. Surface minutely granulate, coarsely punctate, and devoid of hairs. Front bimarginate, upper margin straight, lower margin slightly sinuous, separated from subacute inner orbital angle by a notch. Orbit broad, margin denticulate, two notches above and a closed fissure below the outer tooth; an infraorbital tooth also present. Anterolateral margin with only one tooth behind the flattened exorbital tooth, margin between exorbital and the more slender, cylindrical, and upturned lateral tooth arcuate and denticulate. Ridge on pterygostomian region paralleling epimeral suture blunt, non-striate, and lacking stridulating armature.

Merus of external maxilliped subquadrate, antero-external angle broadly rounded, anterior margin slightly concave, surface matted anteriorly with tomentum.

Chelipeds subequal, the left slightly larger than the right; merus with a sharp spine on upper margin and a dense mat of hairs on internal surface; carpus with a cylindrical tooth on inner margin and a mat of hairs distally; chela with a dense hairy covering externally, leaving only a portion at base of fingers exposed; dactyls slender, elongate, incurving, irregularly dentate, tips crossing.

Ambulatory legs long, slender, carpi and propodi fringed with short hairs, dactyli straight or slightly incurving, with hairy margins.

Male abdomen with seven distinct segments; third segment broadest, like second touching coxae of last pair of walking legs; third to fifth segments concave; base of sixth segment constricted; seventh segment narrowly triangular.

Male first pleopod long, slender, cylindrical, tapering to attenuated tip, and armed with numerous short, conical setae and a few longer setae. Male second pleopod short, curved, tip ovate, concave.

Remarks: *Trizocarcinus peruvianus* differs from *T. tacitus* Chace, 1940, of the western Atlantic by possessing but two anterolateral marginal teeth instead of three, by having the outer surface of the chelae almost completely covered with hairy matting instead of only proximally so, and by having the infraorbital tooth present. Both species differ from *T. dentatus* (Rathbun), 1893, the type species from the Gulf of California, by having the carapace nearly smooth instead of hairy, and by lacking striae on the pterygostomian ridge, which, together with a lamellate ridge on the merus of the cheliped, comprise a stridulating organ in that species. The crisp ridge at the level of the lateral tooth is a further distinguishing feature, although such a ridge is suggested in *T. dentatus*.

The female has been selected as the holotype

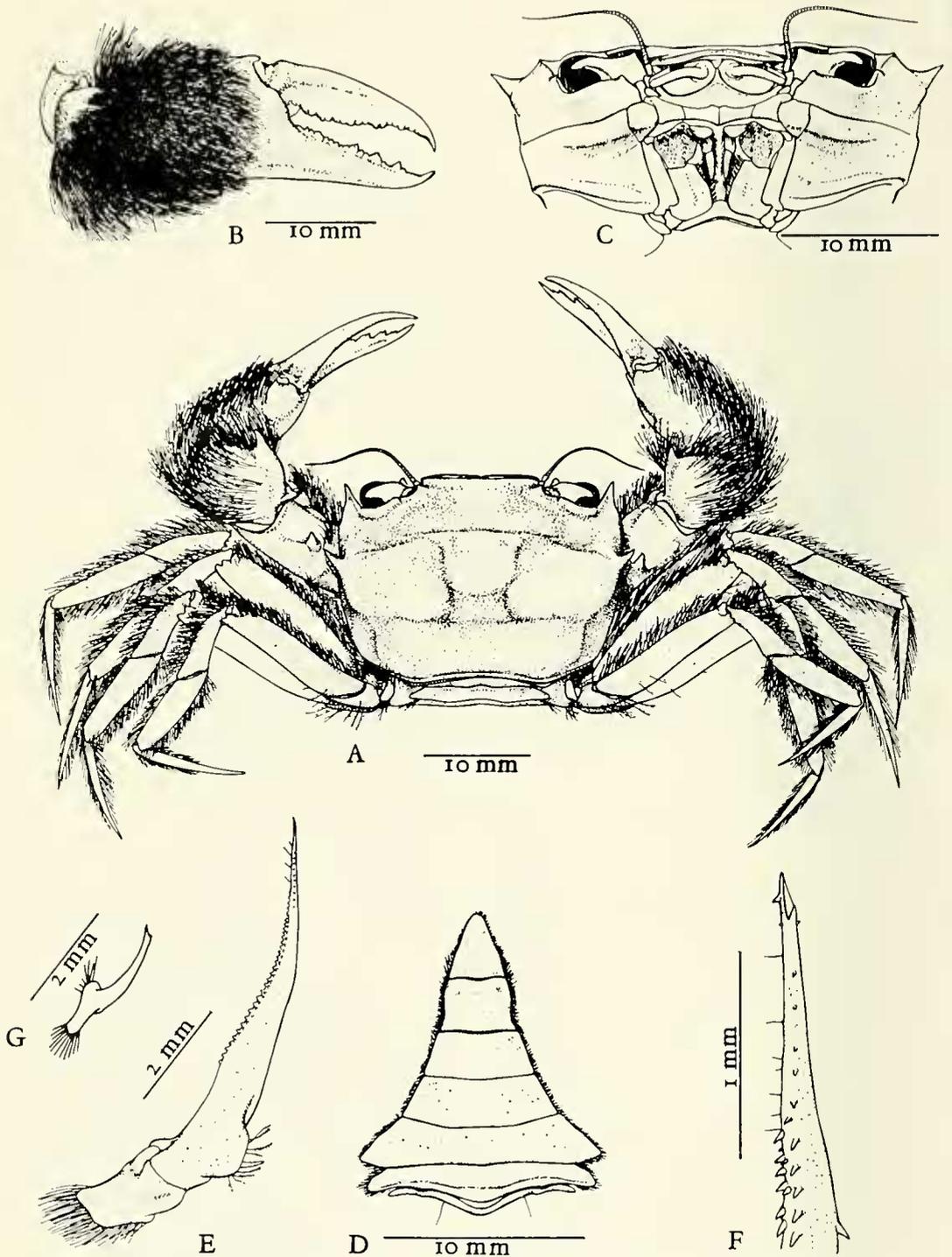


Figure 5. *Trizocarcinus peruvianus*, new species: A-C, female holotype; D-G, male paratype. A, dorsal view; B, outer view of right chela; C, ventral view of front; D, abdomen; E, F, first pleopod; G, second pleopod.

because it has good locality and depth data, both lacking in the male, and is in perfect condition, the male has been dismembered and shows signs of having been dried and rehydrated. The male paratype has been used freely in the description, the male abdomen and gonopod being diagnostic of the species.

DISCUSSION AND CONCLUSIONS

It will have been noted from the foregoing account that the nearest relatives of the newly described eastern Pacific species, where known, are found in the western Atlantic. Thus, the species most closely related to *Honiolodromia robertsi* is *H. paradoxa* A. Milne-Edwards, 1880, off Nevis, Leeward Islands, 356 fathoms; the species most closely related to *Acanthocarpus delsolari* is *A. alexandri* Stimpson, 1871, from Massachusetts to the Windward Islands, 45 to 208 fathoms; the species most closely related to *Pilumnus fernandezi* is *P. diomedea* Rathbun, 1894, from the entrance to the Gulf of Mexico, 130 to 184 fathoms; and the species most closely related to *Trizocarcinus peruvianus* is *T. tacitus* Chace, 1940, off Barbados, 209 fathoms. More remarkable still, although this may be an artifact of collecting, with the exception of *Pilumnus fernandezi*, which occurs off Costa Rica, the newly described species have not been found in the Bay of Panama, nor have their Atlantic counterparts been found in the western Caribbean. All are species of the continental shelf and slope, most from below the 100-fathom line, yet not from such abyssal depths as the Peru-Chile Trench (cf. Garth and Haig, 1971) or the Cayman Trench, yet to be explored.

I believe that these deep-water species represent an older and more fundamental relationship between the two faunas than is indicated by the twin or geminate species found intertidally or subtidally on both sides of the Isthmus of Panama. This circumstance is of potentially great significance to marine zoogeographers, who look to evidence of major displacements of marine biotas as confirmation of geological and paleoclimatological changes. Thus, while it is possible that the pelagic larvae of deep-water brachyuran species were able to cross a shallow-water barrier until mid-Pliocene, the date of the last known isthmian closure, the degree of morphological distinctness between their species pairs, which is of a greater magnitude than now exists between the shallow-water species, suggests that effective interchange between the

now-isolated populations ceased long before. Therefore it is postulated that the analogous pairs of deep-water Amphi-american species have been separated since free communication existed between them at or near the depths at which they presently occur. This would date them from Miocene or earlier, when South America was truly an island continent, separated from North America not by a shallow shelf, but by waters of from 100 to 300 fathoms deep. Furthermore, their absence from the Bay of Panama and the western Caribbean would indicate that this deep-water connection was probably not across the present Isthmus of Panama, but across northern South America, perhaps at the Río Atrato-Buenaventura, Colombia, level of the Bolivar Trench.

The one new species that does not appear to fit into this category, and for which it has been necessary to erect a new genus, is *Delsolaria enriquei*. The family Majidae, to which it belongs, is of New World origin, with most of its numerous genera common to the east and west coasts of the Americas, and with parallel speciation on the two sides. There are several endemic west-coast genera, among them *Loxorhynchus* Stimpson, 1857, and *Mimulus* Stimpson, 1860, of western North America, and *Pisoides* A. Milne-Edwards and Lucas, 1843, and *Lophorochinia* (Garth, 1969) of western South America. These are either north or south temperate in distribution, and do not cross the Equator. *Delsolaria* may be placed provisionally in the latter category until its extra-Peruvian distribution becomes known.

ACKNOWLEDGMENTS

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